Conduct of Operations Course

Lesson:

Radiological Control

Time Required: 60 minutes

Reference:
(a) DOE/EH-0256T, Radiological Controls Manual
(b) DOE 5480.19, Conduct of Operations Requirements for DOE Facilities

Objectives: Upon completion of this lesson:

(VG-9-1)

1. Understand the relationship between the requirements of DOE 5480.19 and DOE/EH-0256T. (3.a)
2. Understand the responsibilities of radiation protection personnel relative to implementation of DOE 5480.19 requirements for radiation protection and contamination control work activities. (3.b)
3. Be familiar with the fundamentals of radiological control including such terms as exposure, contamination, and dosimetry.

Instructional Aids/Materials:

1. Overhead projector, projection screen and viewgraphs
2. Instructor Guide and Student Workbooks
3. DOE-EM-STD-5505-96, Operations Assessments
4. DOE/EH-0256T, Radiological Controls Manual

Presentation Method: Lecture, Class Discussion

Instructor Notes:

1. Instructors should read the contents of this instructor guide and the student workbook, and review applicable portions of the listed references (as needed) when preparing for the lecture. Instructors are free to personalize, however, the key points made in the instructor guide must be covered.

2. The student guide is designed to promote note taking. There are many items in the student guides which do not have the corresponding information filled in, particularly, areas where guidelines are reviewed. The instructor should cover the corresponding information during the lecture and encourage students to take sufficient notes.

3. The italicized words are for instructors only and do not appear in the student workbook.

4. **VG** indicates that there is a viewgraph associated with the information and it should be displayed on the overhead projector.

I. Radiological Controls Overview

(VG-9-2)

The purpose of radiological control is to minimize personnel exposure and to prevent the spread of contamination to the environment. Effective radiological control is an integral part of safe and efficient facility operations and, therefore, elements of radiological control can be found in several chapters of Attachment 1 to DOE 5480.19.

(VG-9-3)

- One of the key principles of the Radiological Control Manual is stated in Article 111:

  "There should not be any occupational exposure of workers to ionizing radiation without the expectation of an overall benefit from the activity causing exposure."

- Per Article 111, this fundamental principle is achieved through ALARA, OWNERSHIP, and EXCELLENCE.

(VG-9-4)

- ALARA is As Low As Reasonably Achievable. This principle deals with maintaining personnel exposure to radiation as low as possible when conducting work by following sound radiological practices.

- Ownership is the idea that minimizing exposure to radiation is everyone's responsibility. The responsibility for maintaining one's exposure as low as possible falls mainly on the individual.

- Excellence can only be achieved when workers are striving to go beyond what is expected by trying to continuously improve their radiological controls program.

- By applying these three key concepts the principle outlined in Article 111 can be achieved. Several chapters in DOE 5480.19 address the same principles of ensuring that workers minimize their radiation exposure levels.

This lesson is intended to familiarize the student with some fundamental concepts related to management, RCT, and individual worker responsibilities as they apply to effective radiological work practices. It also exposes the student to the fundamental elements of measurements associated with radiological control: exposure, contamination, and dosimetry. For a more thorough understanding refer to the DOE Radiological Controls Manual.

II. DOE 5480.19 to DOE/EH - 0256T Matrix

The following table cross-references areas of DOE 5480.19, Attachment 1, to the DOE Radiological Controls Manual.

Topic	**DOE 5480.19**	**DOE/EH - 0256T**
ALARA	Chapter 1, Section 3; Chapter 2, Section 5	Articles 111, 128, 138
OWNERSHIP	Chapter 2, Section 5	Articles 111, 122, 123, 126, 133, 135
EXCELLENCE	Chapter 1	Articles 111, 121, 122, 125, 126, 127, 131, 132, 133, 135, 136

III. Excerpts from the DOE Radiological Controls Manual

The following articles are taken directly from the DOE Radiological Controls Manual and are pertinent to defining complementary types of controls. These articles also describe radiological protection responsibilities of management, RCT personnel, and the individual worker.

In the following sections, where numbers appear before headings, the numbers refer to the identically numbered article in the DOE Radiological Controls Manual. Also, where reference is made to tables, chapters, sections, articles, etc., the references are to the DOE Radiological Controls Manual (DOE/EH - 0256T).

(VG-9-5)

A. Leadership in Radiological Control:

Superior, consistent performance is achieved when qualified personnel use approved procedures and management actively monitors the workplace and assesses ongoing activities.

Constant review and informed interest by senior management is required to achieve a superior radiological control program.

Management at all levels should emphasize the need for high radiological control standards through direct communication, instruction, and inspection of the work space.

The DOE Operations Office Manager and the contractor senior executive responsible for the site should have a basic knowledge of radiation, its effects, and radiological control requirements.

The Operations Office Manager and Contractor Senior Site Executive should also be familiar with the radiological performance record.

(VG-9-6)

1. 121 Senior Management Commitment:

- Establish high standards for the performance of radiological control and frequently communicate expectations to the workforce.
- State in writing their firm commitment to a Radiation Control program of the highest quality, and demonstrate commitment by allocating appropriate resources.
- Solicit feedback from personnel at all levels regarding Radiation Control performance.
- Adopt and promote a positive attitude toward Radiation Control and encourage continuous improvement.
- Require and approve Radiation Control improvement goals and establish a performance measurement program to check progress toward goals.
- Hold workers and their supervisors accountable for Radiation Control performance.
- Ensure that orientation, training, and indoctrination reinforce rules and guidelines for each worker to minimize radiation exposure and control radiological conditions.
- Remain alert for opportunities to minimize generation of radiological waste, control of contamination, and minimization of worker and public exposure.
- Take responsibility and appropriate action to promptly fix or mitigate hazardous or potentially hazardous situations.
- Promote an environment that emphasizes flexibility in adopting improved radiological controls.
- Develop a Radiation Control performance indicator program for trending and effectiveness.

(VG-9-7)

B. Responsibilities Regarding Radiation and Contamination Work Activities

1. 316 Minimization of Internal Exposure: The minimization and control of internal exposure as discussed in Article 136 should be conducted in accordance with the following hierarchy of controls:

- Engineering controls, including containment of radioactive material at the source wherever practicable, should be the primary method of minimizing airborne radioactivity and internal exposure to workers.

- Administrative controls, including access restrictions and the use of specific work practices designed to minimize airborne contamination, should be used as the secondary method to minimize worker internal exposure.

- When engineering and administrative controls have been applied and the potential for airborne radioactivity still exists, respiratory protection should be used to limit internal exposures. Use of respiratory protection should be considered under the following conditions:

    - Entry into posted Airborne Radioactivity Areas;
    - During breach of contaminated systems or components;
    - Work in areas or on equipment with removable contamination levels greater than 100 times the values in Table 2-2; or,
    - During work on contaminated or activated surfaces with the potential to generate airborne radioactivity.

- The selection of respiratory protection equipment should include consideration of worker safety, comfort and efficiency. The use of positive pressure respiratory protection devices is recommended wherever practicable to alleviate fatigue and increase comfort.

- In specific situations the use of respiratory protection may be contraindicated due to physical limitations or the potential for significantly increased external exposure. In such situations, written authorization should be obtained from the line organization manager and the Radiological Control Manager prior to incurring internal exposure. Specific justification of the need to accept the exposure, including a description of measures taken to mitigate the airborne radioactivity, should be documented as part of the authorization process.

- The following controls are applicable for activities authorized in accordance with the above:

  - Stay time controls to limit intake should be established for entry.
  - Evaluation of workplace airborne radioactivity levels should be provided through the use of continuous air monitors or air-samplers with expedited assessment and analysis of results.

(VG-9-8)

2. 511 Requirements (External Dosimetry):

- Personnel dosimetry shall be required for personnel who are expected to receive an annual external whole body dose greater than 100 mrem or an annual dose to the extremities, lens of the eye or skin greater than 10 percent of the corresponding limits specified in Table 2-1. Neutron dosimetry shall be provided when a person is likely to exceed 100 mrem annually from neutrons.

- Dosimeters shall be issued only to personnel formally instructed in their use and shall be worn only by those to whom the dosimeters were issued.

- To minimize the number of personnel in the dosimetry program, the issuance of dosimeters is discouraged to other than personnel entering Radiation Areas, High Radiation Areas or Radiological Buffer Areas where there is a potential for external exposure. Although issuing dosimeters to personnel who are not occupationally exposed to radiation can appear as a conservative practice, it creates the impression that the wearers are occupationally exposed to radiation.

- Personnel shall return dosimeters for processing as scheduled or upon request, and should be restricted by line management from continued radiological work until dosimeters are returned.

- Personnel shall wear their primary dosimeters on the chest area, on or between the waist and the neck, in the manner prescribed by dosimetry personnel.

- Film dosimeters shall not be worn or taken off-site unless specifically authorized by the Radiological Control Manager.

- The practice at some facilities of taking thermoluminescent dosimeters (TLDs) off-site is discouraged and shall not be implemented where not in place.

- Personnel shall not wear dosimeters issued by their resident facilities while being monitored by a dosimeter at another site. Personnel shall not expose their dosimeters to security x-ray devices, excessive heat, or medical sources of radiation.

- A person whose dosimeter is lost, damaged, or contaminated should place work in a safe condition, immediately exit the area and report the occurrence to the Radiological Control Organization. Reentry of the person into Radiological Buffer Areas should not be made until a review has been conducted and management has approved reentry.

(VG-9-9)

3. 221 Personnel Contamination Control:

- Personnel exiting Contamination Areas, High Contamination Areas, Airborne Radioactivity Areas or Radiological buffer Areas established for contamination control shall frisk for contamination as required by Article 338. This does not apply to personnel exiting areas containing only radionuclides, such as tritium, that cannot be detected using hand-held or automatic frisking equipment.

- Monitoring for contamination should be performed using frisking equipment that, under laboratory conditions, can detect total contamination of at least the values specified in Table 2-2. Use of automatic monitoring units that meet the above requirement is encouraged.

- Personnel found with detectable contamination on their skin or personal clothing, other than noble gases or natural background radioactivity, should be promptly decontaminated as described in Article 541.

(VG-9-10)

4. 222 Contamination Control Levels:

- A surface shall be considered contaminated if either the removable or total radioactivity is detected above the levels in Table 2-2. If an area cannot be decontaminated promptly, then it shall be posted as specified in Article 235.

- Surfaces exceeding the values of Table 2-2 for total contamination may be covered with a fixative coating to prevent the spread of contamination. However, reasonable efforts should be made to decontaminate an area before a coating is applied. A fixative coating shall not be applied without the approval of the Radiological Control Manager.

- In addition to the posting criteria in Article 235, the conditions for establishing and maintaining Fixed Contamination Areas include all of the following:

  - Radiological surveys shall be performed to detect contamination that may become removable over time.
  - A formal inventory shall be maintained of Fixed Contamination Areas.
  - Markings shall be kept legible.
  - Removable contamination should be reduced to below detectable levels before a fixative coating is applied.
  - Fixed contamination should be covered with two layers of fixative coatings having different colors.
  - Markings should include the standard radiation symbol, be clearly visible from all directions and contrast with the colors of the surface coatings.
  - Additional coating should be applied when the bottom color appears.
  - A plan should be developed for identifying and adding to the inventory of existing fixed contamination areas not included in the initial inventory.

- A Fixed Contamination Area may be located outside Controlled Areas unless unrestricted access is likely to result in a dose to any person greater than 100 mrem in a year.

- A Fixed Contamination Area is exempt from the general posting requirements of Article 231 and entry and exit requirements of Chapter 3.

- For contaminated soil that is not releasable in accordance with DOE 5400.5, a Soil Contamination Area shall be established that:

  - Is posted as specified in Article 235. Posting should include instructions or special warnings to workers such as "Consult with Radiological Control Organization Before Digging" or "Subsurface Contamination Exists."
  - Meets the requirements of Article 231.1 through 231.8.

- Soil Contamination Areas may be located outside a Radiological Buffer Area.

(VG-9-11)

C. Organizational Information

1. 141 Radiological Control Organization:

- A Radiological Control Organization should be established to provide relevant support to line managers and workers. To effectively function, the Radiological Control Organization should be independent of the line organizational element responsible for production, operation or research activities and should have an equivalent reporting level. A single, dedicated Radiological Control Organization for the site should be sufficient. At larger DOE sites where facilities, buildings or work areas are dispersed, an approach that provides site-wide consistency and individual facility radiological control support is recommended. The senior line manager responsible for operations at a facility should have assigned radiological control personnel dedicated to the facility. Consistency of radiological control is critical. It is not the intent of this Manual to duplicate organizations but to use personnel in a more effective manner in workplace situations.

- Radiological control personnel shall ensure adherence to the Site-Specific Radiological Control Manual and be available to the facility line manager for radiological support to the work force. To effectively function in this capacity, they should receive their day-to-day priorities from facility managers. To ensure independence in making correct radiological decisions, the Radiological Control Organization should be accountable to the Radiological Control Manager.

- The Radiological Control Manager heads the Radiological Control Organization and is responsible for and should establish a high quality Radiological Control Program.

- The Radiological Control Manager shall have access to the senior site executive for radiological control matters.

(VG-9-12)

2. **144 Relationship between Radiological Control Technicians and Workers:** Radiological Control Technicians and their supervisors perform the functions of assisting and guiding workers in the radiological aspects of the job.

- Radiological workers should be sufficiently qualified to recognize the symptoms of deteriorating radiological conditions and seek advice from Radiological Control Technicians and their supervisors.

- Radiological Control Technicians and their supervisors shall have the responsibility and authority to stop work or mitigate the effect of an activity if they suspect that the initiation or continued performance of a job, evolution or test will result in the violation of radiological control standards or result in imminent danger or unacceptable risk. Any worker through their supervisor also has stop work authority in accordance with Article 345.

- The actions or presence of radiological control personnel does not absolve the workers of their responsibility for properly conducting radiological aspects of the job. Radiological control personnel are not present to compensate for poor management of the work force and should not be required to do so. A poorly trained work force should participate in an accelerated training initiative.

(VG-9-13)

D. Individual Information

1. **122 Worker Attitude:** Minimizing worker radiation exposure can be achieved only if all persons involved in radiological activities have an understanding of and the proper respect for radiation.

- Each worker should understand that proper radiological control is an integral part of their daily duties.

- Improving the attitude of the work force should be supported by the training program. To achieve this, training personnel need to be knowledgeable about the work environment and those aspects of radiological control that are important to developing a better worker attitude and perspective.

- The attitude that constant improvement is required in radiological work needs to be developed at all levels of management and in the work force. Cooperation between the work force and the Radiological Control Organization has to be developed and fostered. The workers should not look upon radiological controls as hurdles or restrictions to be bypassed.

- Radiological Control Organization personnel should be helpful in showing workers how to follow the rules. This spirit of cooperation needs to be developed without subverting the control functions of the Radiological Control Technicians. A situation in which radiological controls are left solely to the Radiological Control Organization is unacceptable.

(VG-9-14)

2. 123 Worker Responsibilities: Trained personnel should recognize that their actions directly affect contamination control, personnel radiation exposure and the overall radiological environment associated with their work. The following radiological control rules are applicable to each person in the workplace. A poster that displays the worker responsibilities listed below should be produced and displayed at the appropriate access points and work areas.

TO MINIMIZE YOUR RADIATION EXPOSURE AND CONTROL RADIOACTIVITY, OBSERVE THE FOLLOWING RULES:

OBEY

- Posted, written and oral radiological control instructions and procedures, including instructions on Radiological Work Permits.
- "Evacuate" and "stop work" orders from radiological control personnel promptly.

NOTES